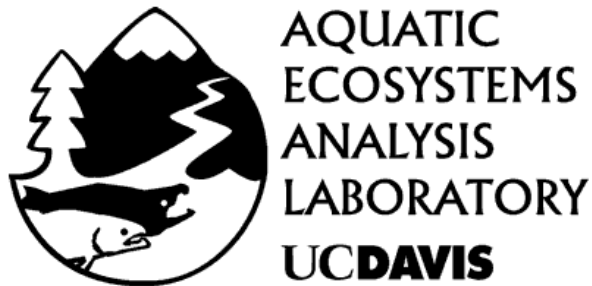


**A Summary of the 2004 TMDL Monitoring for Selected  
Pesticides in the Sacramento-San Joaquin Delta  
January - February 2004**

**Prepared by  
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## **Introduction**

This report describes the results of pesticide monitoring at twelve locations in California's Sacramento-San Joaquin Delta during January and February 2004. Monitoring was conducted by staff of the Aquatic Ecosystems Analysis Laboratory (AEAL) of the John Muir Institute of the Environment, University of California, Davis, as authorized under Contract No. 02-210-150 from the Central Valley Regional Water Quality Control Board (CVRWQCB).

## **Objective**

The primary objective of this project was to monitor twelve sites in the Sacramento-San Joaquin River Delta during the 2003-04 winter storm season in order to characterize the sources of diazinon, chlorpyrifos and other pesticides that can cause surface water contamination and toxic conditions to aquatic life. The results of this study will be used to support the development of diazinon and chlorpyrifos TMDLs in the Sacramento-San Joaquin Delta.

## **Monitoring Overview**

Two sites were monitored once every two weeks from 8 January to 19 February 2004 independent of weather and runoff conditions. Ten additional sites were monitored once per day for five consecutive days during and following two separate storm events in January and February, with two of the sites monitored for a sixth day during each storm event (Figure 1, Table 1). The trigger for initiating a sampling event was a cumulative total of 0.5" of rainfall or more within the sampling area in a 24-hour period. We assumed that rainfall meeting our trigger was sufficient to generate runoff from fields and transport pesticides into waterbodies; we also assumed that rainfall of this magnitude occurred at least twice per winter.

The measured field parameters included pH, water temperature and electrical conductivity (EC). Stream discharge was measured at three sites (Mokelumne River at New Hope Road, Marsh Creek at Cypress Road, and Ulatis Creek at Brown Road) using standard USGS methods and a Swoffer Model 2100 current meter. Discharge estimates

for French Camp Slough at Airport Way were obtained from the California Department of Water Resources (CDWR).

Water samples were delivered to the California Department of Food and Agriculture (CDFA) laboratory in Sacramento, California for chemical analysis using gas chromatography and mass spectrometry (GC-MS). The CDFA laboratory analyzed for 17 chemical compounds in each water sample. The list of compounds is provided in Table 2. The detection frequencies, concentrations and calculated instantaneous loading rates for diazinon and chlorpyrifos are presented in Table 3. The detection frequencies and concentrations of the other 15 compounds are listed in Appendix A.

**Figure 1. The twelve sampling sites in the Sacramento-San Joaquin Delta monitored for pesticides during January and February 2004.**

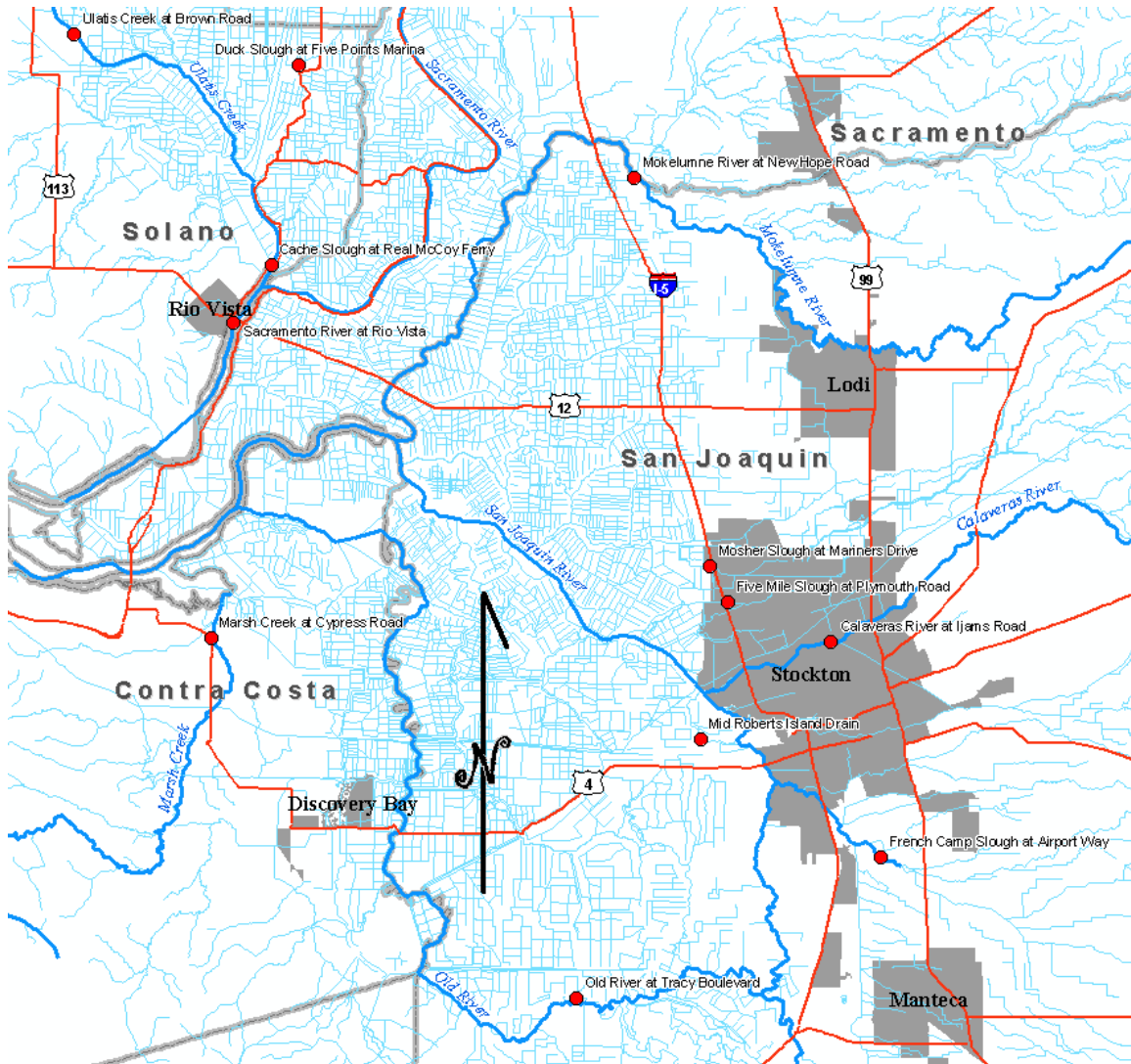


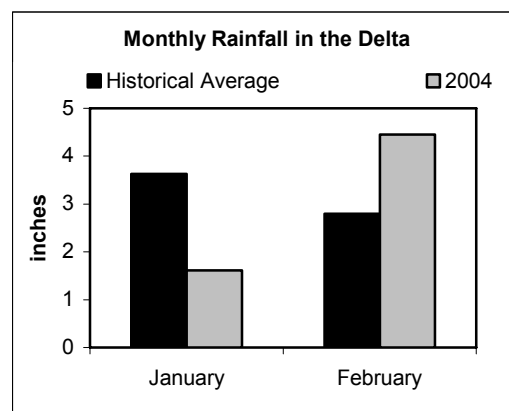
Table 1. Sampling sites, locations, collection methods and sampling dates

Site #	Site Name	Latitude	Longitude	Sample collection Method	Sampling Dates
Delt01	Mokelumne River at New Hope Road	38.2365	-121.4179	Integrated grab from bridge	February 2-6 & 16-20, 2004
Delt02	Mosher Slough at Mariners Drive	38.0327	-121.3639	Grab from bank	February 2-6 & 16-20, 2004
Delt03	Five Mile Slough at Plymouth Road	38.0139	-121.3514	Grab from bank	February 2-6 & 16-20, 2004
Delt04	Calaveras River at Ijams Road	37.9938	-121.2825	Grab from bank	February 2-6 & 16-20, 2004
Delt05	Mid Roberts Island Drain	37.9417	-121.3683	Grab from bank	January 8, 22, February 2, 19
Delt06	French Camp Slough at Airport Way	37.9119	-121.2902	Grab from bank	February 2-6 & 16-20, 2004
Delt08	Old River at Tracy Road	37.8049	-121.4486	Grab from bank	January 8, 22, February 2, 19
Delt09	Marsh Creek at Cypress Road	37.9910	-121.6951	Grab from bank	February 2-6 & 16-20, 2004
Delt10	Ulatis Creek at Brown Road	38.3069	-121.7938	Integrated grab from bridge/Grab from bank	February 2-6 & 16-20, 2004
Delt11	Duck Slough at Five Points Marina	38.2931	-121.6435	Grab from bank	February 2-6 & 16-20, 2004
Delt13	Cache Slough at Real McCoy Ferry	38.1874	-121.6594	Grab from bank	February 2-7 & 16-21, 2004
Delt14	Sacramento River at Rio Vista	38.1572	-121.6836	Integrated grab from pier	February 2-7 & 16-21, 2004

## Hydrologic Conditions During The Study

The rainfall amounts listed in this summary are averages of the combined rainfall accumulations at five rain gages throughout the Delta region: Stockton Airport, Stockton Fire Station (south of Lodi), Lodi, Fairfield and Livermore.

There were no storms in the Delta in January 2004. Delta rainfall for January was 1.61 inches; significantly lower than the historical average of 3.63 inches. Most of the precipitation in January came from isolated showers, the largest of which dropped 0.138 inches in 24 hours. February rainfall total in the Delta of 4.45 inches was significantly higher than the historical average of 2.80 inches.

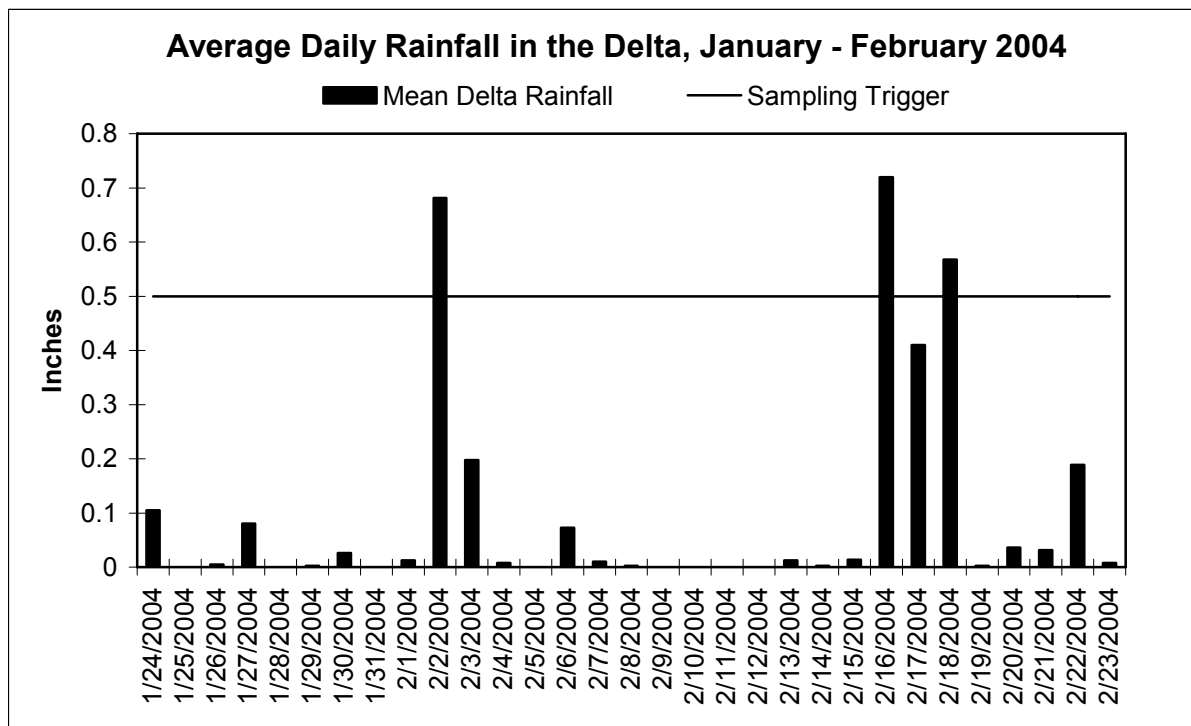


The first major storm event of 2004 fell on February 2<sup>nd</sup> and 3<sup>rd</sup>. The week preceding the first storm was relatively calm with winds of less than 10 mph. Sampling began on February 2<sup>nd</sup> and continued through February 8<sup>th</sup>; during this sampling period 0.97 inches of rain fell in the delta. Within this six-day sampling period the most rain fell on February 2<sup>nd</sup>, a total of 0.68 inches in 24 hours. February 3<sup>rd</sup> also had substantial

rainfall, with 0.20 inches of rain falling in 24 hours. The remaining four days experienced showers accumulating another 0.09 inches.

The second storm event occurred between February 16<sup>th</sup> and February 19<sup>th</sup>, sampling began on the 16<sup>th</sup> and continued through the 21<sup>st</sup>. This storm was preceded by 9 days during which the winds were below 10 mph and rainfall totaled 0.04 inches. During this sampling period 1.77 inches of rain fell. Within this six-day sampling period, the most rain fell on the 16<sup>th</sup>, with 0.72 inches of rain in 24 hours. The 17<sup>th</sup> and 18<sup>th</sup> had substantial rainfall as well, with 0.41 and 0.57 inches, respectively. Smaller showers for the remaining 3 days totaled 0.07 inches.

**Figure 2. Average daily rainfall in the Sacramento-San Joaquin Delta, California, during the 2003-04 winter storm sampling.**



## **Sample Collection Methods**

All samples were collected by either grab or integrated grab methods (Table 1). Grab samples were collected by harnessing a 1-liter amber glass bottle to a pole sampler and dipping the bottle into the stream as close to the center of the channel as possible. Integrated grab samples were collected by lowering a 3-liter PTFE (polytetrafluoroethylene) bottle, strapped in a weighted cage, from a bridge at three equally spaced verticals. At each vertical the bottle was filled approximately  $\frac{1}{4}$  full. The composite sample was then thoroughly agitated and poured into a 1-liter amber glass sample bottle. Sampling methods were adapted from Azimi-Gaylon and Reyes (2002) and can be found in Appendix D: *Standard Operating Procedures for Collecting Water Samples in the Sacramento-San Joaquin Delta*.

## **Discharge Methods**

At Marsh Creek and Ulati Creek discharge was measured using a Swiffer Model 2100 current meter while wading. At the Mokelumne River, and at Ulati Creek during high flows, discharge was measured from a bridge using a bridgeboard, sounding reel and Swiffer Model 2100 current meter. All measurements were made using standard USGS current-meter methods (Nolan, et al. 2001) with the following exception: due to current meter failure, discharge at the Mokelumne River on Feb 18 was measured using the float-method (Nolan, et al. 2001).

The float method is a crude means of determining stream velocity by timing the travel of a floating object, such as an orange peel or a stick, along a known length of stream, repeating the process at varying distances across the channel width, averaging the measured velocities then applying the average velocity to an area-velocity equation. The discharge we calculated using this method fit nicely into a normal bell-shaped hydrograph when plotting it with the discharge measurements made on the preceding three days and the following two days.

Discharge estimates for French Camp Slough at Airport Way were provided courtesy of John Tingle of the California Department of Water Resources (CDWR) from the CDWR gage located on site.



No discharge measurements were made at any of the other sites due to tidal influences, safety considerations and site logistics.

### **Loading Rate Calculations**

Daily loading rates of diazinon and chlorpyrifos were calculated by multiplying the stream discharge at the time of sample collection by the measured concentrations of each pesticide by the number of seconds (86,400) in one day. Loading rates were only calculated when the pesticide concentration was above the limit of detection and a discharge estimate was available. The loading rate was assumed to be zero for all samples where pesticide concentrations were below the limit of detection.

### **Laboratory Analysis Methods**

Upon arrival at the CDFA laboratory, the environmental samples were weighed then spiked with 500 $\mu$ L of 1.0  $\mu$ g/ml chlorpyrifos methyl (0.5 $\mu$ g/mL) surrogate spiking solution. Each sample was emptied into a 2-liter separatory funnel and approximately 10-15g of granular sodium chloride was added. Sixty ml of methylene chloride were added and the sample was then mixed for three minutes. The organic fraction was filtered through a bed of granular anhydrous sodium sulfate (approx. 20g). The extraction process was repeated three times and the resultant sample was evaporated to 5-7 ml at 40° C and then evaporated to dryness with an N-evaporator. One ml of methylene chloride and 10 $\mu$ L of a 5.0 $\mu$ g/mL internal standard solution were added to each sample. Samples were stored in a -5°C freezer until analysis. Samples were analyzed with an Agilent Model 5973 GC-MSD using a HP-5MS or equivalent GC column. Analysis was performed in the selective ion-monitoring mode (CCAC, 2003).

Each sample was analyzed for seventeen compounds. The compounds and their respective method detection limit (MDL) and reporting limit (RL) are listed in Table 2. The lab reported estimated values when the values were below the RL but above the MDL. To ensure the accuracy and precision of the sample analysis, lab spikes, blanks, and a surrogate standard (chlorpyrifos methyl) were used. If the recovery of a spike sample was out of the control range, the water sample was re-analyzed.

Table 2. CDFA method detection limits and reporting limits for select pesticides

Compound	Method Detection Limit (MDL in µg/L)	Reporting Limit (RL in µg/L)
Azinphos methyl	0.007	0.050
Bifenthrin	0.007	0.050
Carbaryl	0.007	0.020
Chlorpyrifos	0.004	0.010
Cyanazine	0.007	0.050
Cyfluthrins	0.070	0.200
Cypermethrins	0.070	0.200
Dacthal (DCPA)	0.007	0.050
Diazinon	0.007	0.020
Disulfoton	0.007	0.020
EPTC (Eptam)	0.020	0.050
Esfenvalerate	0.007	0.050
I-Cyhalothrin	0.030	0.100
Methidathion	0.010	0.030
Metolachlor	0.007	0.020
Propargite	0.150	0.500
Simazine	0.005	0.200

### Quality Assurance Objectives

Sampling during the 2003-04 winter storm season was conducted under the guidance of a draft Quality Assurance Project Plan (QAPP): *San Joaquin River TMDL Quality Assurance Project Plan Azimi-Gaylon and Reyes (2002)*.

Sampling and analysis precision and variability were measured through the use of field duplicates. The draft QAPP stated the Quality Assurance Objective (QAO) for precision was a relative percent difference (RPD) of  $\leq 25\%$ .

Accuracy was measured by determining the percent recovery of known concentrations of spiked analytes in matrix spike samples and surrogate analytes spiked into environmental samples or reagent water prior to extraction. No QAO for analyte or surrogate recovery was established in the draft QAPP, so a commonly accepted standard of 70-130% recovery (D. McClure, personal communication September 2005) was used as the QAO for accuracy in laboratory analytical measurements when evaluating data for this report

All results falling outside of the QAO for accuracy in surrogate recovery were flagged as follows: BL = results should be viewed as biased low due to low surrogate

recovery in sample. BH = results should be viewed as biased high due to high surrogate recovery in sample. Concentrations below the reporting limit are considered estimates and flagged with the letter “J” to identify them as data that have failed precision criteria but are deemed useable. All flagged data are reviewed and categorized as useable or unusable for the purposes of this report (Azimi-Gaylon and Reyes, 2002).

## **Results**

A total of 112 environmental samples (Table 3) and 23 quality control (QC) samples (Table 4) were collected and analyzed.

### *Environmental samples*

Concentrations of diazinon and chlorpyrifos ranged from below detection to 0.520 parts per billion (ppb) of diazinon in the Calaveras River on 2 February 2004 and 0.510 ppb chlorpyrifos in Duck Slough on 18 February 2004 (Table 3).

The highest calculated instantaneous loading rates for both diazinon and chlorpyrifos were in Ulati Creek (Table 3).

Other pesticides detected in the environmental samples were Bifenthrin, Carbaryl, Cyanazine, Dacthal (DCPA), Eptam (EPTC), Esfenvalerate, Methidathion, Metolachlor and Simazine (Appendix A).

Four environmental samples had surrogate recoveries outside of the QAO acceptance limits and were flagged either BH or BL; see footnotes in Table 3 and Appendix A.

### *Environmental Quality Control Samples*

Sample quality control was measured through collection of sequential and split duplicates (n=9), field blanks (n=7) and matrix spikes (n=7). Duplicate samples provided a measure of analytical precision; field blanks were used to evaluate possible introduction of contaminants during sample collection, handling and transport to the lab; matrix spikes were used to evaluate the accuracy of extracting spiked chemicals from the sample matrix; surrogate recoveries provided a measure of analytical accuracy for individual samples.

The procedures used for collecting the QA/QC samples were based on the draft San Joaquin River TMDL Quality Assurance Project Plan (Azimi-Gaylon and Reyes, 2002)

The QAO for precision and variability was a relative percent difference (RPD) of  $\leq 25\%$  between a duplicate sample and the corresponding environmental sample concentrations. Eight of nine duplicate pairs met the QAO. The RPDs for diazinon and chlorpyrifos ranged from 0 – 105.26% and 0 – 114.96%, respectively (Table 4).

The single highest RPD values for both diazinon and chlorpyrifos were likely due to low recoveries of those compounds in the environmental sample collected at Mosher Slough on 2 February 2004; the surrogate recovery for the environmental sample was 29% while the surrogate recovery for the corresponding duplicate sample was 121%. The data with the low recovery was flagged with an “R” to indicate that it was rejected because, due to an extremely low surrogate recovery, it cannot be reasonably estimated at what levels pesticides were present in the sample. In this case the duplicate sample results should be used in lieu of the rejected environmental sample.

A duplicate sample from Five Mile Slough on 17 February had a surrogate recovery of 135%, exceeding the QAO of 70-130%. The corresponding environmental sample had a surrogate recovery of 130%. The RPD between the two samples was 18.18% for chlorpyrifos and 0% for diazinon. The similar rates of surrogate recovery and the low RPD values indicate an acceptable level of precision in the analytical method.

The QAO acceptance limit for field blanks was “less than the reporting limit”. All seven field blanks met the acceptance limits with no detections of any pesticides in any blank (Table 4).

The QAO acceptance limit for matrix spikes was a 70-130% recovery rate for both chlorpyrifos and diazinon. Each of the seven matrix spikes met the QAO objective for recovery. Recoveries ranged from 88-119% for chlorpyrifos and 88-115% for diazinon (Table 4).

#### *Laboratory Quality Control Samples*

Seventeen lab blanks and 17 lab control matrix spikes were analyzed with the environmental samples. The QAO acceptance limits for lab blanks and lab control matrix

spikes were recoveries of 70-130% each for bifenthrin, chlorpyrifos, diazinon and the surrogate (chlorpyrifos methyl).

Surrogate recoveries in lab blanks ranged from 79-122% (Appendix B). Surrogate recoveries in lab control matrix spikes ranged from 85-128%, 82-109%, 87-119% and 92-124% for bifenthrin, chlorpyrifos, diazinon and chlorpyrifos methyl, respectively (Appendix C).

All laboratory quality control samples met the quality assurance objectives.

## **Overall Data Quality Assessment**

### *Usable Data*

Data categorized as “usable” are used to calculate daily loads and to assess the precision and accuracy of the individual analyses based on QC sample results. All data not flagged are considered usable data.

All of the 112 environmental samples were analyzed for chlorpyrifos, diazinon and 15 other compounds. Of these environmental samples 28 analyses for chlorpyrifos and 20 for diazinon were J-flagged, with the J-flag denoting a concentration that is above the Method Detection Limit (MDL) but below the Reporting Limit (RL) and is therefore considered to be an estimate. These data are considered usable. Six of the 23 QC samples were J-flagged, and with one exception (explained below) are considered usable. All J-flagged data is considered usable to the extent that it indicates the presence of a particular pesticide although not in a quantifiable concentration.

A duplicate sample from Five Mile Slough on 17 February had a surrogate recovery of 135%, exceeding the QAO of 70-130%. The corresponding environmental sample had a surrogate recovery of 130%. The RPD between the two samples was 18.18% for chlorpyrifos and 0% for diazinon. The similar rates of surrogate recovery and the low RPD values indicate an acceptable level of precision in the analytical method. These data are considered precise and usable although of marginal accuracy.

All other data in this report are considered usable with the exception of the one sample discussed below.

### *Unusable Data*

Unusable data are results that failed to meet accuracy criteria and have been determined to be unreliable even with the addition of a data qualifier code. The environmental sample from Mosher Slough on 2 February 2004 had a 29% surrogate recovery compared with the 121% surrogate recovery in a corresponding duplicate sample. The relative percent differences (RPD) in recoveries of chlorpyrifos (115%) and diazinon (105%) between the environmental and duplicate samples far exceeded the precision QAO of  $\leq 25\%$ . For these reasons the environmental sample was flagged with an “R” to indicate that the results have been rejected for use.

### *Completeness*

The overall completeness objective for this project was 95% as stated in the draft QAPP. The completeness for environmental samples (n=112) was 99%. The completeness for field quality control samples (n=23), and for lab quality control samples (n=34), was 100% each. The overall completeness was 99%.



Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. February 2004.

Cfs: cubic ft/second J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit; R: data rejected.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt01	Mokelumne River at New Hope Road	2/2/2004	17:10	NA	ND	NA	(0.012 J)	NA
		2/3/2004	8:00	292.76	0.010	7.16	0.073	52.29
		2/4/2004	8:10	274.75	ND	NA	(0.014 J)	9.41
		2/5/2004	8:00	238.37	ND	NA	ND	NA
		2/6/2004	8:10	238.37	ND	NA	ND	NA
		2/16/2004	12:00	308.30	0.043	32.43	0.059	44.50
		2/17/2004	15:10	NA	ND	NA	(0.009 J)	NA
		2/18/2004	16:40	284.99 <sup>1</sup>	(0.006 J)	4.18	(0.017 J)	11.85
		2/19/2004	8:20	232.02	ND	NA	(0.012 J)	6.81
		2/20/2004	8:10	196.35	ND	NA	ND	NA
Delt02	Mosher Slough at Mariners Drive	2/2/2004	17:00 <sup>2</sup>	NA	(0.027) FDP, R	NA	(0.180) FDP, R	NA
		2/2/2004	17:05 <sup>3</sup>	NA	0.100	NA	0.580	NA
		2/3/2004	9:50	NA	0.100	NA	0.480	NA
		2/4/2004	10:10	NA	0.038	NA	0.400	NA
		2/5/2004	10:00	NA	0.023	NA	0.410	NA
		2/6/2004	10:30	NA	0.048	NA	0.410	NA
		2/16/2004	16:30	NA	0.037	NA	0.180	NA
		2/17/2004	9:20 <sup>4</sup>	NA	BH (0.020)	NA	BH (0.160)	NA
		2/18/2004	10:00	NA	0.011	NA	0.140	NA
		2/19/2004	10:30	NA	0.041	NA	0.130	NA

<sup>1</sup> Float-method was used to estimate discharge. See explanation in Discharge Methods section.

<sup>2</sup> Surrogate recovery (29%) was outside of QAO for accuracy. Results should be viewed as biased low, discarded, and replaced with results from the field duplicate; see note 3.

<sup>3</sup> The results of the field duplicate are presented in lieu of the environmental sample in the discussion due to complications noted in footnote 2. Surrogate recovery (121%) of the field duplicate was within the QAO for accuracy.

<sup>4</sup> Surrogate recovery (133%) was outside of QAO for accuracy. Results should be viewed as biased high



Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. February 2004.

Cfs: cubic ft/second J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit; R: data rejected.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
		2/20/2004	11:30	NA	0.020	NA	0.130	NA
Delt03	Five Mile Slough at Plymouth Road	2/2/2004	16:50	NA	(0.007 J)	NA	0.330	NA
		2/3/2004	10:10	NA	0.044	NA	0.300	NA
		2/4/2004	10:20	NA	ND	NA	0.290	NA
		2/5/2004	10:20	NA	ND	NA	0.300	NA
		2/6/2004	10:50	NA	0.043	NA	0.320	NA
		2/16/2004	16:00	NA	0.021	NA	0.160	NA
		2/17/2004	9:40	NA	(0.006 J)	NA	0.160	NA
		2/18/2004	10:20	NA	ND	NA	0.120	NA
		2/19/2004	10:40	NA	ND	NA	0.130	NA
		2/20/2004	11:40	NA	ND	NA	0.110	NA
Delt04	Calaveras River at Ijams Road	2/2/2004	16:10	NA	0.068	NA	0.520	NA
		2/3/2004	10:40	NA	0.027	NA	0.240	NA
		2/4/2004	11:00	NA	(0.006 J)	NA	0.043	NA
		2/5/2004	10:50	NA	ND	NA	0.022	NA
		2/6/2004	11:20	NA	0.011	NA	0.022	NA
		2/16/2004	15:40	NA	0.014	NA	0.170	NA
		2/17/2004 <sup>5</sup>	10:00	NA	BH (0.018)	NA	BH (0.170)	NA
		2/18/2004	10:50	NA	0.015	NA	0.110	NA
		2/19/2004	11:10	NA	(0.009 J)	NA	(0.016 J)	NA
		2/20/2004	12:00	NA	(0.005 J)	NA	(0.007 J)	NA
Delt05	Mid Roberts Island Drain	1/8/2004	12:20	NA	ND	NA	ND	NA
		1/22/2004	11:20	NA	ND	NA	(0.019 J)	NA
		2/5/2004	12:30	NA	(0.009 J)	NA	0.062	NA

<sup>5</sup> Surrogate recovery (136%) was outside of the QAO for accuracy. Results should be viewed as biased high.

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. February 2004.

Cfs: cubic ft/second J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit; R: data rejected.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
		2/19/2004	12:40	NA	ND	NA	0.026	NA
Delt06	French Camp Slough at Airport Way	2/2/2004	15:20	9.99	0.015	0.37	0.210	5.13
		2/3/2004	11:30	9.99	0.012	0.29	0.160	3.91
		2/4/2004	14:10	9.65	0.016	0.38	0.280	6.61
		2/5/2004	11:20	105.00	0.012	3.08	0.440	113.03
		2/6/2004	12:30	73.40	(0.005 J)	0.90	0.085	15.26
		2/16/2004	15:10	10.70	(0.004 J)	0.10	0.043	1.13
		2/17/2004	10:50	10.70	(0.006 J)	0.16	0.043	1.13
		2/18/2004	11:20	10.70	(0.006 J)	0.16	0.130	3.40
		2/19/2004	11:40	526.00	0.011	14.16	0.055	70.78
		2/20/2004	12:40	214.00	(0.004 J)	2.09	0.026	13.61
Delt08	Old River at Tracy Boulevard	1/8/2004	11:30	NA	ND	NA	ND	NA
		1/22/2004	10:40	NA	ND	NA	0.028	NA
		2/5/2004	11:50	NA	(0.006 J)	NA	0.027	NA
		2/19/2004	12:10	NA	ND	NA	(0.014 J)	NA
Delt09	Marsh Creek	2/2/2004	15:20	19.07	ND	NA	0.086	4.01
		2/3/2004	11:00	14.13	(0.008 J)	0.28	0.087	3.01
		2/4/2004	10:40	13.77	(0.006 J)	0.20	0.054	1.82
		2/5/2004	10:30	7.42	ND	NA	0.044	0.80
		2/6/2004	10:40	4.94	(0.006 J)	0.07	0.028	0.34
		2/16/2004	14:40	41.67	ND	NA	0.077	7.85
		2/17/2004	12:40	3.53	ND	NA	0.065	0.56
		2/18/2004	12:30	373.98	0.012	10.98	0.047	43.00
		2/19/2004	10:30	104.18	ND	NA	(0.011 J)	2.80
		2/20/2004	10:40	41.32	ND	NA	(0.007 J)	0.71

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. February 2004.

Cfs: cubic ft/second J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit; R: data rejected.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt10	Ulatis Creek at Brown Rd	2/2/2004	14:10	NA	0.030	NA	0.025	NA
		2/3/2004	13:20	604.59	0.091	134.60	0.035	51.77
		2/4/2004	13:20	321.72	0.085	66.90	0.024	18.89
		2/5/2004	13:00	228.84	0.095	53.19	0.021	11.76
		2/6/2004	13:00	176.93	0.091	39.39	0.021	9.09
		2/16/2004	16:30	1687.33	ND	NA	ND	NA
		2/17/2004	10:20	897.70	0.120	263.55	0.100	219.62
		2/18/2004	10:10	3092.51	0.039	295.07	0.052	393.42
		2/19/2004	12:50	398.70	0.110	107.30	0.030	29.26
		2/20/2004	12:50	205.88	0.086	43.32	(0.020 J)	10.07
Delt11	Duck Slough at Five Points Marina	2/2/2004	13:10	NA	0.020	NA	0.027	NA
		2/3/2004	16:10	NA	0.230	NA	0.024	NA
		2/4/2004	16:40	NA	0.360	NA	0.032	NA
		2/5/2004	16:50	NA	0.120	NA	0.028	NA
		2/6/2004	8:50	NA	0.100	NA	0.024	NA
		2/16/2004	12:50	NA	(0.009 J)	NA	(0.007 J)	NA
		2/17/2004	15:30	NA	0.025	NA	(0.015 J)	NA
		2/18/2004	16:10	NA	0.510	NA	(0.013 J)	NA
		2/19/2004	8:50	NA	0.400	NA	(0.016 J)	NA
		2/20/2004	10:30	NA	0.190	NA	(0.017 J)	NA
Delt13	Cache Slough at Real McCoy Ferry	2/2/2004	13:40	NA	(0.004 J)	NA	0.055	NA
		2/3/2004	15:30	NA	ND	NA	0.029	NA
		2/4/2004	16:10	NA	ND	NA	(0.020 J)	NA
		2/5/2004	16:20	NA	ND	NA	0.023	NA
		2/6/2004	9:30	NA	ND	NA	0.096	NA

Table 3. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. February 2004.

Cfs: cubic ft/second J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit; R: data rejected.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt13	Cache Slough at Real McCoy Ferry <i>continued</i>	2/7/2004	9:50	NA	(0.004 J)	NA	0.074	NA
		2/16/2004	13:20	NA	ND	NA	0.021	NA
		2/17/2004	15:10	NA	ND	NA	(0.018 J)	NA
		2/18/2004	15:40	NA	(0.004 J)	NA	(0.017 J)	NA
		2/19/2004	9:20	NA	ND	NA	0.037	NA
		2/20/2004	10:10	NA	(0.010 J)	NA	0.038	NA
		2/21/2004	10:50	NA	(0.006 J)	NA	0.039	NA
Delt14	Sacramento River at Rio Vista	2/2/2004	14:10	NA	ND	NA	0.035	NA
		2/3/2004	14:40	NA	(0.006 J)	NA	0.037	NA
		2/4/2004	15:30	NA	(0.006 J)	NA	0.027	NA
		2/5/2004	15:50	NA	ND	NA	0.026	NA
		2/6/2004	9:40	NA	ND	NA	0.086	NA
		2/7/2004	9:20	NA	ND	NA	0.066	NA
		2/16/2004	13:50	NA	(0.005 J)	NA	0.024	NA
		2/17/2004 <sup>6</sup>	14:30	NA	ND	NA	0.025	NA
		2/18/2004	15:10	NA	ND	NA	0.027	NA
		2/19/2004	9:40	NA	(0.009 J)	NA	0.036	NA
		2/20/2004	9:40	NA	(0.009 J)	NA	0.038	NA
		2/21/2004	10:20	NA	(0.005 J)	NA	0.029	NA

<sup>6</sup> Surrogate recovery (133%) was outside of the QAO for accuracy. Results should be viewed as biased high and discarded.

Table 4. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento-San Joaquin River Delta, February 2004.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: micrograms per liter; J: the reported concentrations were below the quantitative limit and are considered estimates; <: less than; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit; R: data is rejected						
Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Relative percent difference (chlorpyrifos)	Diazinon (ug/L)	Relative percent difference (diazinon)
<b>DUPLICATES</b>						
Delt02	Mosher Slough at Mariners Drive	02/02/2004 17:00 <sup>1</sup> 02/02/2004 17:05	BL (0.027) FDP, R 0.100	114.96%	BL (0.180) FDP, R 0.580	105.26%
Delt03	Five Mile Slough at Plymouth Road	02/17/2004 09:40 02/17/2004 09:45 <sup>2</sup>	(0.006 J) BH (0.005 J) FDP	18.18%	0.160 BH (0.160) FDP	0.00%
Delt04	Calaveras River at Ijams Road	02/18/2004 10:50 02/18/2004 10:55	0.015 0.013	14.29%	0.110 0.100	9.52%
Delt05	Mid Roberts Island Drain	02/05/2004 12:30 02/05/2004 12:35	(0.009 J) (0.007 J)	25.00%	0.062 0.065	4.72%
Delt06	French Camp Slough at Airport Way	02/05/2004 11:20 02/05/2004 11:25	0.012 (0.010 J)	18.18%	0.440 0.420	4.65%
Delt08	Old River at Tracy Boulevard	01/22/2004 10:40 01/22/2004 10:45	<0.004 <0.004	NA	0.028 0.026	7.41%
Delt09	Marsh Creek at Cypress Road	02/04/2004 10:40 02/04/2004 10:45	(0.006 J) (0.006 J)	0.00%	0.054 0.059	8.85%
Delt10	Mokelumne River at New Hope Road	02/17/2004 15:10 02/17/2004 15:15	ND ND	NA	(0.009 J) (0.011 J)	20.00%
Delt14	Sacramento River at Rio Vista	02/21/2004 10:20 02/21/2004 10:25	(0.005 J) (0.004 J)	22.22%	0.029 0.036	21.54%
<b>BLANKS</b>						
Delt03	Five Mile Slough at Plymouth Road	02/03/2004 10:15	<0.004		<0.007	
Delt06	French Camp Slough at Airport Way	02/19/2004 11:45	<0.004		<0.007	
Delt08	Old River at Tracy Boulevard	02/19/2004 12:15	<0.004		<0.007	
Delt09	Marsh Creek at Cypress Road	02/19/2004 10:35	<0.004		<0.007	
Delt10	Ulati Creek at Brown Road	02/06/2004 13:05	<0.004		<0.007	
Delt11	Duck Slough at Five Points Marina	02/06/2004 08:55	<0.004		<0.007	
Delt13	Cache Slough at Real McCoy Ferry	02/16/2004 13:25	<0.004		<0.007	
Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Percent recovery (chlorpyrifos)	Diazinon (ug/L)	Percent recovery (diazinon)
<b>SPIKES<sup>3,4</sup></b>						
Delt01	Mokelumne River at New Hope Road	02/02/2004 17:10 02/02/2004 17:10	<0.004	109%	(0.012 J)	103%
Delt02	Mosher Slough at Mariners Drive	02/16/2004 16:30 02/16/2004 16:30	0.037	119%	0.180	88%
Delt04	Calaveras River at Ijams Road	02/04/2004 11:00 02/04/2004 11:00	(0.006 J)	104%	0.043	93%
Delt05	Mid Roberts Island Drain	01/08/2004 12:20 01/08/2004 12:20	<0.004	112%	<0.007	104%

Table 4. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento-San Joaquin River Delta, February 2004.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: micrograms per liter; J: the reported concentrations were below the quantitative limit and are considered estimates; <: less than; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit; R: data is rejected						
Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Percent recovery (chlorpyrifos)	Diazinon (ug/L)	Percent recovery (diazinon)
SPIKES <i>continued</i>						
Delt11	Duck Slough at Five Points Marina	02/20/2004 10:30 02/20/2004 10:30	0.190	88%	(0.017 J)	104%
Delt13	Cache Slough at Real McCoy Ferry	02/07/2004 09:50 02/07/2004 09:50	(0.004 J)	93%	0.074	115%
Delt14	Sacramento River at Rio Vista	02/02/2004 14:10 02/02/2004 14:10	<0.004	105%	0.035	88%

<sup>1</sup> Sample had extremely low surrogate recovery of 29%. Results should be viewed as biased low and discarded.

<sup>2</sup> Sample had high surrogate recovery (135%). Results should be viewed as biased high and discarded.

<sup>3</sup> Spiked samples were injected with 0.05 ug/L of chlorpyrifos; 0.10 ug/L of diazinon.

<sup>4</sup> First sample in each pair is the environmental sample; second sample is the spike.

## **Sources Cited**

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## Appendices



## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit. Each sample was also analyzed for Azinphos methyl, Cyfluthrins, Cypermethrins, Disulfoton, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Bifenthrin	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Esfen-valerate	Methidathion	Metolachlor	Simazine
Mokelumne River at New Hope Road	2/2/2004	17:10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mokelumne River at New Hope Road	2/3/2004	8:00	ND	ND	ND	ND	ND	ND	ND	ND	(0.057 J)
Mokelumne River at New Hope Road	2/4/2004	8:10	ND	ND	ND	ND	ND	ND	ND	ND	(0.011 J)
Mokelumne River at New Hope Road	2/5/2004	8:00	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mokelumne River at New Hope Road	2/6/2004	8:10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mokelumne River at New Hope Road	2/16/2004	12:00	ND	ND	ND	ND	ND	ND	ND	ND	0.520
Mokelumne River at New Hope Road	2/17/2004	15:10	ND	ND	ND	ND	ND	ND	ND	ND	(0.021 J)
Mokelumne River at New Hope Road	2/18/2004	16:40	ND	ND	ND	ND	ND	ND	ND	ND	(0.057 J)
Mokelumne River at New Hope Road	2/19/2004	8:20	ND	ND	ND	ND	ND	ND	ND	ND	(0.051 J)
Mokelumne River at New Hope Road	2/20/2004	8:10	ND	ND	ND	ND	ND	ND	ND	ND	(0.090 J)
Mosher Slough at Mariners Drive	2/2/2004	17:00 <sup>1</sup>	ND	BL (0.053) FDP	ND	ND	ND	ND	ND	ND	BL (0.029 J) FDP
Mosher Slough at Mariners Drive	2/3/2004	9:50	ND	0.140	ND	(0.008 J)	ND	ND	ND	ND	3.900
Mosher Slough at Mariners Drive	2/4/2004	10:10	ND	ND	ND	(0.007 J)	ND	ND	ND	(0.007 J)	2.600
Mosher Slough at Mariners Drive	2/5/2004	10:00	ND	ND	ND	ND	ND	ND	ND	ND	2.300
Mosher Slough at Mariners Drive	2/6/2004	10:30	ND	ND	ND	ND	ND	ND	ND	ND	2.000
Mosher Slough at Mariners Drive	2/16/2004	16:30	ND	ND	ND	(0.008 J)	ND	ND	ND	ND	0.850
Mosher Slough at Mariners Drive	2/17/2004	9:20 <sup>7</sup>	ND	ND	ND	BH (0.010 J)	ND	ND	ND	ND	BH (4.800)
Mosher Slough at Mariners Drive	2/18/2004	10:00	ND	ND	ND	(0.010 J)	ND	ND	ND	ND	0.960
Mosher Slough at Mariners Drive	2/19/2004	10:30	ND	0.054	ND	(0.009 J)	ND	ND	ND	(0.008 J)	0.600
Mosher Slough at Mariners Drive	2/20/2004	11:30	ND	ND	ND	(0.008 J)	ND	ND	ND	(0.007 J)	0.820

<sup>1</sup> Surrogate recovery (29%) was outside of QAPP acceptance limits. Results should be viewed as biased low.

<sup>7</sup> Surrogate recovery (133%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit. Each sample was also analyzed for Azinphos methyl, Cyfluthrins, Cypermethrins, Disulfoton, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Bifenthrin	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Esfen-valerate	Methidathion	Metolachlor	Simazine
Five Mile Slough at Plymouth Road	2/2/2004	16:50	ND	ND	ND	ND	ND	ND	ND	ND	(0.034 J)
Five Mile Slough at Plymouth Road	2/3/2004	10:10	ND	0.032	ND	ND	ND	ND	ND	ND	(0.047 J)
Five Mile Slough at Plymouth Road	2/4/2004	10:20	ND	ND	ND	ND	ND	ND	0.053	ND	(0.051 J)
Five Mile Slough at Plymouth Road	2/5/2004	10:20	ND	ND	ND	ND	ND	(0.033 J)	ND	ND	(0.052 J)
Five Mile Slough at Plymouth Road	2/6/2004	10:50	ND	ND	ND	ND	ND	ND	ND	ND	(0.060 J)
Five Mile Slough at Plymouth Road	2/16/2004	16:00	ND	ND	ND	ND	ND	ND	ND	ND	(0.079 J)
Five Mile Slough at Plymouth Road	2/17/2004	9:40	ND	ND	ND	ND	ND	ND	ND	ND	BH (0.077 J) FDP
Five Mile Slough at Plymouth Road	2/18/2004	10:20	ND	ND	ND	(0.008 J)	ND	ND	ND	ND	(0.12 J)
Five Mile Slough at Plymouth Road	2/19/2004	10:40	ND	0.097	ND	ND	ND	ND	ND	ND	(0.13 J)
Five Mile Slough at Plymouth Road	2/20/2004	11:40	ND	ND	ND	ND	ND	ND	(0.016 J)	ND	(0.13 J)
Calaveras River at Ijams Road	2/2/2004	16:10	ND	0.490	ND	(0.012 J)	ND	ND	ND	ND	0.200
Calaveras River at Ijams Road	2/3/2004	10:40	ND	0.380	ND	(0.007 J)	ND	ND	ND	0.027	(0.179 J)
Calaveras River at Ijams Road	2/4/2004	11:00	ND	ND	ND	ND	ND	ND	ND	(0.008 J)	0.920
Calaveras River at Ijams Road	2/5/2004	10:50	ND	ND	ND	ND	ND	ND	ND	ND	0.990
Calaveras River at Ijams Road	2/6/2004	11:20	ND	ND	ND	ND	ND	ND	ND	ND	1.000
Calaveras River at Ijams Road	2/16/2004	15:40	ND	ND	ND	(0.013 J)	ND	ND	(0.011 J)	0.026	0.470
Calaveras River at Ijams Road	2/17/2004 <sup>8</sup>	10:00	ND	BH (1.300)	ND	BH (0.016 J)	ND	ND	ND	BH (0.051)	BH (0.390)
Calaveras River at Ijams Road	2/18/2004	10:50	ND	ND	ND	(0.018 J)	ND	ND	ND	0.051	0.490
Calaveras River at Ijams Road	2/19/2004	11:10	ND	ND	ND	ND	ND	ND	ND	(0.007 J)	0.750
Calaveras River at Ijams Road	2/20/2004	12:00	ND	ND	ND	ND	ND	ND	ND	ND	0.400
Mid Roberts Island Drain	1/8/2004	12:20	ND	ND	ND	ND	ND	ND	ND	0.140	0.310
Mid Roberts Island Drain	1/22/2004	11:20	ND	ND	ND	ND	ND	ND	ND	0.069	(0.091 J)

<sup>8</sup> Surrogate recovery (136%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit. Each sample was also analyzed for Azinphos methyl, Cyfluthrins, Cypermethrins, Disulfoton, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Bifenthrin	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Esfen-valerate	Methidathion	Metolachlor	Simazine
Mid Roberts Island Drain	2/5/2004	12:30	ND	ND	ND	ND	ND	ND	ND	0.073	(0.17 J)
Mid Roberts Island Drain	2/19/2004	12:40	ND	ND	ND	ND	ND	ND	ND	0.180	(0.11 J)
French Camp Slough at Airport Way	2/2/2004	15:20	ND	ND	ND	(0.014 J)	ND	ND	ND	ND	0.210
French Camp Slough at Airport Way	2/3/2004	11:30	ND	ND	ND	(0.015 J)	ND	ND	ND	ND	(0.160 J)
French Camp Slough at Airport Way	2/4/2004	14:10	ND	ND	ND	(0.011 J)	ND	ND	0.070	ND	0.210
French Camp Slough at Airport Way	2/5/2004	11:20	ND	ND	ND	ND	ND	ND	ND	ND	0.350
French Camp Slough at Airport Way	2/6/2004	12:30	ND	ND	ND	ND	ND	ND	ND	ND	1.800
French Camp Slough at Airport Way	2/16/2004	15:10	ND	ND	ND	(0.013 J)	ND	ND	ND	ND	0.490
French Camp Slough at Airport Way	2/17/2004	10:50	ND	ND	ND	(0.017 J)	ND	ND	ND	ND	0.460
French Camp Slough at Airport Way	2/18/2004	11:20	ND	ND	ND	(0.014 J)	ND	ND	ND	(0.007 J)	1.200
French Camp Slough at Airport Way	2/19/2004	11:40	ND	ND	ND	ND	ND	ND	ND	(0.009 J)	1.800
French Camp Slough at Airport Way	2/20/2004	12:40	ND	ND	ND	ND	ND	ND	ND	ND	1.300
Old River at Tracy Boulevard	1/8/2004	11:30	ND	ND	ND	ND	ND	ND	ND	ND	(0.095 J)
Old River at Tracy Boulevard	1/22/2004	10:40	ND	ND	ND	ND	ND	ND	ND	ND	ND
Old River at Tracy Boulevard	2/5/2004	11:50	ND	ND	ND	ND	ND	ND	ND	ND	(0.070 J)
Old River at Tracy Boulevard	2/19/2004	12:10	ND	ND	ND	ND	ND	ND	ND	(0.011 J)	(0.066 J)
Marsh Creek at Cypress Road	2/2/2004	15:20	(0.044 J)	0.130	ND	ND	ND	ND	ND	ND	0.230
Marsh Creek at Cypress Road	2/3/2004	11:00	(0.021 J)	0.920	ND	ND	ND	ND	ND	ND	(0.043 J)
Marsh Creek at Cypress Road	2/4/2004	10:40	(0.046 J)	0.660	ND	ND	ND	ND	ND	ND	(0.100 J)
Marsh Creek at Cypress Road	2/5/2004	10:30	ND	2.300	ND	ND	ND	ND	ND	ND	(0.072 J)
Marsh Creek at Cypress Road	2/6/2004	10:40	ND	1.400	ND	ND	ND	ND	0.099	ND	0.300
Marsh Creek at Cypress Road	2/16/2004	14:40	(0.026 J)	1.800	ND	ND	ND	ND	0.085	0.030	(0.130 J)
Marsh Creek at Cypress Road	2/17/2004	12:40	ND	1.200	ND	ND	ND	ND	ND	(0.009 J)	(0.032 J)
Marsh Creek at Cypress Road	2/18/2004	12:30	ND	0.140	ND	ND	ND	ND	ND	0.037	(0.130 J)

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit. Each sample was also analyzed for Azinphos methyl, Cyfluthrins, Cypermethrins, Disulfoton, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Bifenthrin	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Esfen-valerate	Methidathion	Metolachlor	Simazine
Marsh Creek at Cypress Road	2/19/2004	10:30	ND	(0.019 J)	ND	ND	ND	ND	ND	ND	0.230
Marsh Creek at Cypress Road	2/20/2004	10:40	ND	ND	ND	ND	ND	ND	ND	ND	(0.110 J)
Ulatis Creek at Brown Road	2/2/2004	14:10	ND	ND	ND	ND	ND	ND	ND	ND	0.250
Ulatis Creek at Brown Road	2/3/2004	13:20	ND	ND	ND	ND	ND	ND	ND	0.021	4.200
Ulatis Creek at Brown Road	2/4/2004	13:20	ND	ND	ND	ND	ND	ND	ND	0.025	3.800
Ulatis Creek at Brown Road	2/5/2004	13:00	ND	ND	ND	ND	ND	ND	ND	(0.014 J)	1.800
Ulatis Creek at Brown Road	2/6/2004	13:00	ND	ND	ND	ND	ND	ND	ND	(0.010 J)	1.300
Ulatis Creek at Brown Road	2/16/2004	16:30	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ulatis Creek at Brown Road	2/17/2004	10:20	ND	ND	ND	ND	ND	ND	ND	(0.015 J)	1.700
Ulatis Creek at Brown Road	2/18/2004	10:10	ND	ND	ND	ND	ND	ND	ND	0.029	2.500
Ulatis Creek at Brown Road	2/19/2004	12:50	ND	ND	ND	ND	ND	ND	ND	0.037	1.100
Ulatis Creek at Brown Road	2/20/2004	12:50	ND	ND	ND	ND	ND	ND	ND	0.021	0.590
Duck Slough at Five Points Marina	2/2/2004	13:10	ND	ND	ND	ND	ND	ND	ND	ND	2.100
Duck Slough at Five Points Marina	2/3/2004	16:10	ND	ND	ND	ND	ND	ND	ND	ND	0.890
Duck Slough at Five Points Marina	2/4/2004	16:40	ND	ND	ND	ND	ND	ND	ND	ND	0.290
Duck Slough at Five Points Marina	2/5/2004	16:50	ND	ND	ND	ND	ND	ND	ND	0.036	0.360
Duck Slough at Five Points Marina	2/6/2004	8:50	ND	ND	ND	ND	ND	ND	ND	ND	0.220
Duck Slough at Five Points Marina	2/16/2004	12:50	ND	ND	ND	ND	ND	ND	ND	ND	0.320
Duck Slough at Five Points Marina	2/17/2004	15:30	ND	ND	ND	ND	ND	ND	ND	ND	(0.150 J)
Duck Slough at Five Points Marina	2/18/2004	16:10	ND	ND	ND	ND	ND	ND	ND	0.033	2.800
Duck Slough at Five Points Marina	2/19/2004	8:50	ND	ND	ND	ND	ND	ND	ND	ND	2.600
Duck Slough at Five Points Marina	2/20/2004	10:30	ND	ND	ND	ND	(0.037 J)	ND	ND	ND	0.700
Cache Slough at Real McCoy Ferry	2/2/2004	13:40	ND	ND	ND	ND	ND	ND	ND	ND	(0.045 J)
Cache Slough at Real McCoy Ferry	2/3/2004	15:30	ND	ND	ND	ND	ND	ND	ND	ND	(0.036 J)

## Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample; BH: result should be viewed as biased high due to high surrogate recovery in sample; FDP: field duplicate RPD above QC limit. Each sample was also analyzed for Azinphos methyl, Cyfluthrins, Cypermethrins, Disulfoton, Propargite and I-Cyhalothrin which were not present at detectable levels).

Site	Date	Time	Bifenthrin	Carbaryl	Cyanazine	Dacthal (DCPA)	Eptam (EPTC)	Esfen-valerate	Methidathion	Metolachlor	Simazine
Cache Slough at Real McCoy Ferry	2/4/2004	16:10	ND	ND	ND	ND	ND	ND	ND	ND	(0.051 J)
Cache Slough at Real McCoy Ferry	2/5/2004	16:20	ND	ND	ND	ND	ND	ND	ND	ND	(0.057 J)
Cache Slough at Real McCoy Ferry	2/6/2004	9:30	ND	ND	ND	ND	ND	ND	ND	ND	(0.072 J)
Cache Slough at Real McCoy Ferry	2/7/2004	9:50	ND	ND	ND	ND	ND	ND	ND	ND	(0.039 J)
Cache Slough at Real McCoy Ferry	2/16/2004	13:20	ND	ND	ND	ND	ND	ND	ND	ND	(0.028 J)
Cache Slough at Real McCoy Ferry	2/17/2004	15:10	ND	ND	ND	ND	ND	ND	ND	ND	(0.027 J)
Cache Slough at Real McCoy Ferry	2/18/2004	15:40	ND	ND	ND	ND	ND	ND	ND	ND	(0.039 J)
Cache Slough at Real McCoy Ferry	2/19/2004	9:20	ND	ND	ND	ND	ND	ND	ND	ND	0.310
Cache Slough at Real McCoy Ferry	2/20/2004	10:10	ND	ND	ND	ND	ND	ND	ND	ND	0.260
Cache Slough at Real McCoy Ferry	2/21/2004	10:50	ND	ND	ND	ND	ND	ND	ND	ND	(0.190 J)
Sacramento River at Rio Vista	2/2/2004	14:10	ND	ND	ND	ND	ND	ND	ND	ND	(0.045 J)
Sacramento River at Rio Vista	2/3/2004	14:40	ND	ND	ND	ND	ND	ND	ND	ND	(0.017 J)
Sacramento River at Rio Vista	2/4/2004	15:30	ND	ND	ND	ND	ND	ND	ND	ND	(0.051 J)
Sacramento River at Rio Vista	2/5/2004	15:50	ND	ND	ND	ND	ND	ND	ND	ND	(0.065 J)
Sacramento River at Rio Vista	2/6/2004	9:40	ND	ND	ND	ND	ND	ND	ND	ND	(0.076 J)
Sacramento River at Rio Vista	2/7/2004	9:20	ND	ND	ND	ND	ND	ND	ND	ND	(0.038 J)
Sacramento River at Rio Vista	2/16/2004	13:50	ND	ND	ND	ND	ND	ND	ND	ND	(0.037 J)
Sacramento River at Rio Vista	2/17/2004 <sup>9</sup>	14:30	ND	ND	ND	ND	ND	ND	ND	ND	BH (0.041 J)
Sacramento River at Rio Vista	2/18/2004	15:10	ND	ND	ND	ND	ND	ND	ND	ND	(0.085 J)
Sacramento River at Rio Vista	2/19/2004	9:40	ND	ND	ND	ND	ND	ND	ND	ND	0.310
Sacramento River at Rio Vista	2/20/2004	9:40	ND	ND	ND	ND	ND	ND	ND	ND	0.280
Sacramento River at Rio Vista	2/21/2004	10:20	ND	ND	ND	ND	ND	ND	ND	ND	(0.180 J)

<sup>9</sup> Surrogate recovery (133%) was outside of QAPP acceptance limits. Results should be viewed as biased high.

## Appendix B. Lab blank data

(No pesticides were present at detectable levels. The pesticides include azinphos methyl, bifenthrin, carbaryl, chlorpyrifos, cyanazine, cyfluthrin, cypermethrin, dacthal (DCPA), diazinon, disulfoton, EPTC (Eptam), esfenvalerate, methidathion, metolachlor, propargite, I-Cyhalothrin and simazine)

<b>Date Extracted</b>	<b>Chlorpyrifos Methyl (Surrogate) Recovery</b>
1/9/2004	108%
1/23/2004	113%
2/4/2004	103%
2/4/2004	106%
2/5/2004	98%
2/6/2004	79%
2/9/2004	94%
2/10/2004	107%
2/10/2004	122%
2/17/2004	101%
2/18/2004	84%
2/19/2004	100%
2/20/2004	97%
2/23/2004	118%
2/24/2004	104%
2/25/2004	118%
2/26/2004	97%

## Appendix C. Recovery rates in lab control matrix spikes

<b>Date Extracted</b>	<b>Bifenthrin</b>	<b>Chlorpyrifos</b>	<b>Diazinon</b>	<b>Surrogate</b>
1/9/2004	109%	103%	101%	114%
1/23/2004	91%	106%	98%	112%
2/4/2004	99%	109%	89%	107%
2/4/2004	93%	106%	100%	113%
2/5/2004	85%	82%	90%	103%
2/6/2004	104%	84%	90%	98%
2/9/2004	97%	103%	95%	100%
2/10/2004	117%	92%	110%	118%
2/10/2004	128%	102%	119%	124%
2/17/2004	116%	102%	97%	108%
2/18/2004	122%	86%	87%	92%
2/19/2004	102%	89%	91%	106%
2/20/2004	101%	106%	93%	114%
2/23/2004	118%	101%	106%	108%
2/24/2004	120%	102%	100%	112%
2/25/2004	111%	99%	98%	114%
2/26/2004	122%	105%	100%	114%

Appendix D: Standard Operating Procedures for Collecting Water Samples in the  
Sacramento-San Joaquin Delta

# Standard Operating Procedure for Collecting Water Samples in the Sacramento-San Joaquin Delta

(September 2003 AW)

## Overview of the sampling sites and sampling methods:

**D** = Discharge measurements are taken at these sites

<b>Delta 1</b>	Mokelumne River at New Hope Road	BRIDGE / 3L Teflon <b>D</b>
<b>Delta 2</b>	Mosher Slough at Mariners Drive	BRIDGE / 3L Teflon
<b>Delta 3</b>	Five-Mile Slough at Plymouth Road	BANK—grab sample
<b>Delta 4</b>	Calaveras River at Ijams Road	BRIDGE / 3L Teflon
<b>Delta 5</b>	Mid Roberts Island Drain	BANK—grab sample
<b>Delta 6</b>	French Camp Slough at S Manthey Road	BANK—grab sample
<b>Delta 7</b>	Paradise Cut at Paradise Road	BRIDGE / 3L Teflon
<b>Delta 8</b>	Old River at Tracy Road	BANK—grab sample
<b>Delta 9</b>	Marsh Creek at Cypress Road	BANK—grab sample <b>D</b>
<b>Delta 10</b>	Ulatis Creek at Brown Road	BRIDGE / 3L Teflon <b>D</b>
<b>Delta 11</b>	Duck Slough	BANK—grab sample
<b>Delta 12</b>	Steamboat Slough	BANK—grab sample
<b>Delta 13</b>	Cache Slough before Sac River	BANK—grab sample
<b>Delta 14</b>	Sac River at Rio Vista	BRIDGE / 3L Teflon

## 1. Labeling the sample bottles

- Use preprinted labels. The sample ID should have the following format:

### DP YYMMDD-nn

DP (=Delta Pesticides)

YYMMDD-nn = Year, Months, Day

nn = sample number in sampling order (01, 02, 03...)

Example: first sample taken on 8/20/02: ID = DP020820-01; a duplicate would be DP020820-02; a spike on the same site would be DP020820-03 Spike

Date 09/10/03 \_\_\_\_\_



Time 10:50 Initials AW\_

I.D. DP030910-01 \_\_\_\_\_

- The label should include the sample ID, date, sample time, and your initials



- Complete the printed label with an extra-fine-point Sharpie. Cover the entire label with a piece of clear tape to prevent peeling.
- Use 24-hour military time for the sample time; round to the nearest 10 minutes. For example: a sample collected at 09:52 would have the sample time on the label and Chain of Custody (COC) form rounded off to 09:50; a sample collected at 09:57 would be rounded up to 10:00; 09:55 would also be rounded up to 10:00. Use the following format for the date: mm/dd/yy

## 2. Check the Quality Control Schedule to see if a QC sample is scheduled for the site

If so, label an additional 1L amber glass bottle according to the instructions in Step 5 below. Read the QC sampling procedure before sampling.

## 3. Fill out Field Sheet at each sampling site

### How to fill out the field sheet:

- Station ID: for example Delta01
- Station Name: Mokelumne River at New Hope Road
- Sampling time: rounded 24-hour military time (e.g. 14:00)

#### Sampling Information

- Sampling bottle: 1L amber bottles are glass, 3L bottles are Teflon
- Sample type: integrated grab is from bridge, grab is from bank
- Stage: will become apparent with experience, also can be researched later on web or read from a staff gage, if present

#### Sample Collected

- Write the sample ID for the environmental sample next to 'Field Sample'
- If a quality control sample is scheduled, place a check beside the sample type required and record the sample ID for the QC

Always double check sample ID's on the field sheet, COC, and label. Sample ID's on the field sheets are the only way to identify the samples!

#### Field Measurements

Use Oakton pH/conductivity/temp meters; allow the probe to soak in native water for a few minutes for the reading to stabilize. Note the values for temperature, pH and EC on the field sheet along with appropriate units (e.g. mS, uS, °C).

- BANK: measure directly from river edge
- BRIDGE: after pouring off sample use excess water from 3L Teflon bottle for the field measurements; rinse probe and plastic container with that native water

- before pouring another portion out of 3L bottle into the measuring container. Measure test parameters immediately after pouring off sample so that conditions (temperature) do not change
- Flow and stage fields will be completed in the lab by getting information from CDEC or USGS web sites; please note source, date of receiving the information and your initials on the field sheet

At the end of the day fill the electrode storage cap with electrode storage solution before placing the meter in its case.

Note anything significant or unusual under Observations on the field sheet; for example waste disposal, irrigation runoff, foam on water surface, dead fish, etc.

Original forms stay with UC Davis in a prepared folder at the IOE. At the end of each sampling day, field sheets are faxed to Jamie Lu (916) 255-3015

Recalibrate Oakton pH/conductivity/temp meters once a month. Record recalibration date on a piece of labeling tap and affix to inside panel of meter case.

## 4. How to collect a sample

*Always wear clean gloves during sampling procedure!*

### BANK

- a) Using bungee cord, affix 1L amber glass bottle to sampling pole.  
To attach 250mL ELISA bottle:
  - (i) slide bungee through grating with blue ball on the bottom
  - (ii) loop through grating
  - (iii) slip pre-attached white cord over bottle top
  - (iv) slip bungee over bottle top
- b) Check to insure the bottle is secure
- c) Remove the cap (wear clean glove!)
- d) Immerse the bottle until bubbles stop. Fill completely; do not leave any headspace
- e) Replace the cap (still wearing the clean glove!)
- f) Rinse the outside of the bottle with deionized water
- g) Slip the bottle into a foam sleeve
- h) Place sample directly into a cooler (up to 15 1L bottles can be placed in one cooler).  
Make sure there is no glass-to-glass contact.

### BRIDGE SAMPLE

1. Put on your orange safety vest. Always be aware of traffic and use caution while sampling from a bridge
2. At the van, put the 3L Teflon bottle into the TECHMA cage, secure it with the bungee cord (you will lose the bottle, if the bungee cord is not strapped around the bottle!), and remove the cap

1. Wearing leather gloves, carefully lower the bottle from the bridge railing to the water surface. Do not lower too fast or the bottle may be propelled from the cage upon impact. Perform a triple rinse with native water. Fill the bottle at least  $\frac{1}{4}$  full for each rinse
2. To collect the sample, fill the bottle  $\frac{1}{4}$ <sup>th</sup> at each of three equally spaced verticals (submerge for about 3-5 seconds), being careful to avoid contact between the bottle and anything but river water, especially when moving between verticals
3. Return to the van
4. Remove the 3L bottle from the TECHMA cage and swirl the water until completely mixed
5. The second person has already labeled the sample bottle. While wearing clean gloves the second person removes the bottle cap and holds the sample bottle as the sampler pours from the 3L Teflon bottle into the sample bottle. After the sample bottle is completely filled the second person then recaps the sample bottle
6. Rinse the outside of the sample bottle with deionized water, place the bottle in a protective sleeve and store it in the cooler.

The last thing to do before filling any amber glass sample bottle, regardless of method, is to remove the lid. The first thing to do after filling any amber glass sample bottle, regardless of method, is to replace the lid. If you have more than one sample bottle to fill, remove each lid just prior to filling the bottle

Clean the 3L bottle after sampling with the following procedure:

- While wearing clean gloves, add 10% liquinox soap mixture (2-3 squeezes) and approximately 50ml of deionized water to the Teflon bottle. Place the cap on the bottle and swirl the soap around inside the bottle until the entire inside surface has been covered with suds. Un-cap the bottle and pour the soap onto the ground. Rinse the bottle and cap using deionized water until no suds remain inside the bottle or on the cap
- Pour 5-10ml of methanol into the bottle and swirl, with the cap on, until methanol has covered the entire inside surface of the bottle. Carefully pour the waste methanol into the methanol waste container. Seal the methanol bottle and waste container with Parafilm to prevent fume leakage. *Methanol is dangerous—do not inhale or touch!*
- The 3L bottle is ready for the next sampling and should be stored, with the cap on, inside the TECHMA cage

## 5. If scheduled collect a quality control sample

View the QC Schedule to find out which type of QC sample you should collect that day

-- -- Field duplicate:

- a) Collect both samples simultaneously. If using a pole sampler place two bottles in the sampler. If using the TECHMA fill the 3L Teflon bottle with enough water for both the environmental and duplicate samples

- a) Mark the sampling time of the duplicate sample by adding **5 minutes** to the time of the environmental sample (e.g. environmental sample collected at 14:00 then duplicate time is 14:05). **Do not** indicate *duplicate* on the label or on the COC!

-- Matrix spike:

For the matrix spike sample record the same sampling time as the environmental sample. Mark as “matrix spike” on the **COC and label**. It should be made obvious so that the lab knows that this sample needs to be spiked.

BRIDGE SAMPLE

- a) From the single 3L Teflon filled using the procedure above pour the collected water into two 1L bottles; one for the environmental sample and one for the matrix spike.

BANK SAMPLE

Fill two 1L bottles with one reach of the pole sampler; one for the environmental sample and one for the matrix spike.

-- Blank sample:

**Do not** indicate blank on label or on COC. Time offset: add **5 minutes** to the time of the environmental sample (e.g. environmental sample collected at 14:00 then blank time is 14:05).

BRIDGE SAMPLE

*BEFORE TAKING ENVIRONMENTAL SAMPLE:*

- a) Rinse the clean 3L Teflon bottle three times with deionized water (approximately 50ml for each rinse)  
b) Fill the 3L bottle 2/3 full with deionized water and pour into a 1L bottle for the blank.

BANK SAMPLE

- a) Fill one 1L bottle with deionized water for the blank.

-- Equipment blank:

**One** Equipment Blank needs to be taken the first time you use a new sampling pole. Clean a large bucket with 10% liquinox soap and deionized water (methanol is not necessary). Put the clean bucket under the pole, rinse the pole using >2 liters deionized water. With the water collected in the bucket, fill a 1L bottle. Do not indicate “field blank” on the label or COC, however indicate this on the field sheet. No time offset necessary.

6. Whoever did not fill out the field sheet and COC should double check all of the recorded times for

completeness and error at the end of the sampling day

## 7. Check ice level

The temperature of the ice chest should be around 4°C. Make sure to add ice if necessary.

## 8. Deliver the samples within 48 hours

### **Samples need to be dropped off at:**

- **(1L amber glass bottles)** open from 8 am to 5 pm after hours call Stephen Siegel, California Department of Food and Agriculture, Center for Analytical Chemistry, 3292 Meadowview Road, Sacramento, Ca 95832 Responsible Person: Stephen Siegel, (916) 275-3735 or [ssiegel@cdfa.ca.gov](mailto:ssiegel@cdfa.ca.gov)  
No drop off on weekends or on holidays unless pre-arranged! (For storage in our facility or somewhere else over the weekend make sure that there is enough ice in the cooler and the temperature stays around 4 degrees C)

## 9. Complete Chain of Custody forms

Complete Chain of Custody forms for each sampling day

- The original COC's will stay in the CDFA Lab. Be sure to have Steve Siegel (or other lab recipient) make you a copy of the COC. Upon return to the IOE fax a copy of the COC and the field sheets to Jamie Lu within 24 hours (FAX: (916) 255-3015) and one copy will be staying with UC Davis in a prepared folder at the IOE. After faxing, put your name, date, and time of fax on our copy and file it

Sample transfer between field staff and laboratory is documented by **signing and dating** “relinquished by” and “received by” blocks whenever sample possession changes. The document must have both yours **and** the lab’s signature before faxing it to Jamie.

### **Discharge Measurements:**

Discharge will be measured using a Swoffer Velocity Meter Model 2100 by the Delta Team at Delta 01, Delta 09, and Delta 10. Use the bridgeboard and sounding reel at Delta 01 and (when flows are too high to safely wade) at Delta 10. Use the wading rod at Delta 09 and Delta 10. For details see *Standard Operating Procedure for Velocity Measurement and Discharge Calculation Using the Swoffer Model 2100 Current Meter*.

Pumping station records and gauge data need to be documented on the field sheets. Pumping records need to be documented for Delta 05 and Delta 10. Gauge data should be documented for Delta 08 and Delta 14. In addition, precipitation data should be documented for Thornton, Brentwood, and Dixon, California. Also storm patterns and rainfall data should be documented as accurately as possible to create a detailed record of the event.